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TITLE: METHOD AND SYSTEM FOR INITIATING A VEHICLE DATA UPLOAD FUNCTION AT A PLURALITY OF MOBILE VEHICLES

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METHOD AND SYSTEM FOR INITIATING A VEHICLE DATA UPLOAD FUNCTION AT A PLURALITY OF MOBILE VEHICLES

CROSS REFERENCE TO RELATED APPLICATION

This application is a ***continuation***-in-***part*** to co-pending U.S. patent application Ser. No. 10/115,321, filed April 3, 2002, which is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

This invention relates generally to data transmissions over a wireless communication system. More specifically, the invention relates to a method and system for initiating a vehicle data upload function, at a plurality of mobile vehicles, using a satellite radio broadcast system.

BACKGROUND OF THE INVENTION

Wireless communication services for mobile vehicles, such as navigation and roadside assistance, have increased rapidly in recent years. Most of the available services apply to a motor vehicle in operation, but more recently, the demands and potential for services to a turned-off vehicle have grown. Services requested while the vehicle is off or in a quiescent mode include maintenance and diagnostic functions, system updates, vehicle position determination, unlocking of the doors, or vehicle alarm setting and silencing.

Normally when the mobile vehicle equipped with a telematics unit or vehicle communication device is turned off, equipment is placed into a powered-down or sleep mode. This sleep or discontinuous-receive mode includes, for example, a time when the vehicle communication device is scheduled to awaken and the duration for the vehicle communication device to be awake. The discontinuous-receive mode includes storing information such as time and vehicle location at the initiation of the sleep mode. The discontinuous-receive mode includes setting a time for the next wakening period, and a duration for the next service-ready mode. The discontinuous-receive mode also includes actions to place other systems in the mobile vehicle into a quiescent or powered-down mode, including for example the vehicle communications device, the telematics unit, or both. While powered down, the vehicle communication device checks an on-board clock or timer to determine when it is time to awaken.

A communication device and a telematics unit are placed into a powered-down mode for minimal power drain on the battery. To perform a requested function while the ignition is off, the vehicle is awakened, the desired function performed, and the vehicle placed back into the sleep mode.

One method currently in use is to synchronize the wake-up time with an incoming call from a telematics or service call center. When the vehicle is awakened, a call is received and responded to appropriately. The time period between wake-up operations varies from ten minutes, to several days or more if the vehicle has not been moved or driven for a while. To coordinate the wake-up function with the call from the call center, time at the call center and at the mobile vehicle needs to be synchronized. A global positioning system (GPS) unit in the mobile vehicle provides an accurate reading of time. After the call is received and the vehicle responds, the vehicle is put back into the sleep mode again after a predetermined duration, minimizing battery drain.

Unfortunately, a prescribed wake-up schedule will not always accommodate the immediate needs of the user or service subscriber. A vehicle in long-term parking at an airport, for example, has been powered down for a while, but requires immediate telematics assistance when the owner returns to a vehicle with keys locked inside. When a vehicle is stolen, for example, a vehicle owner will want to retrieve vehicle location information quickly.

A method with a quicker response time is needed to make vehicle services available when the vehicle is powered down or turned off. This would result in increased subscriber satisfaction with telematics services. Increased availability and timeliness of services is compromised by the need to maintain low power consumption. The method would improve the availability of a vehicle to receive and perform a service request, while maintaining low power consumption.

It is an object of this invention, therefore, to provide a method for improving the availability of a quiescent vehicle to receive and perform a service request, and to overcome the deficiencies and obstacles described above.

SUMMARY OF THE INVENTION

A method of initiating a vehicle data upload function at a plurality of mobile vehicles. A satellite radio system broadcast channel is monitored for a call center initiated vehicle data upload command signal at the plurality of mobile vehicles. A determination is made, at the plurality of mobile vehicles, whether the vehicle data upload command signal corresponds to a mobile vehicle. The vehicle data upload command signal is extracted from the broadcast channel based on the determination. A vehicle data upload function is performed based on the extracted vehicle data upload command signal. The method further comprises determining the plurality of mobile vehicles at a call center based on a service criterion.

A computer usable medium including computer program code for initiating a vehicle data upload function at a plurality of mobile vehicles, comprising: computer program code for monitoring a satellite radio system broadcast channel for a call center initiated vehicle data upload command signal at the plurality of mobile vehicles. The medium further includes computer program code for determining at the plurality of mobile vehicles whether the vehicle data upload command signal corresponds to a mobile vehicle and computer program code for extracting the vehicle data upload command signal from the broadcast channel based on the determination Additionally, the medium includes computer program code for performing a vehicle data upload function based on the extracted vehicle data upload command signal. The computer usable medium further comprises computer program code for determining the plurality of mobile vehicles at a call center based on a service criterion.

A system including means for initiating a vehicle data upload function at a plurality of mobile vehicles, comprising: means for monitoring a satellite radio system broadcast channel for a call center initiated vehicle data upload command signal at the plurality of mobile vehicles. The system further includes means for determining at the plurality of mobile vehicles whether the vehicle data upload command signal corresponds to a mobile vehicle and means for extracting the vehicle data upload command signal from the broadcast channel based on the determination. Additionally, the system includes means for performing a vehicle data upload function based on the extracted vehicle data upload command signal. The system further comprises means for determining the plurality of mobile vehicles at a call center based on a service criterion.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an illustration of one embodiment of a system for accessing a quiescent mobile vehicle equipped with a telematics unit and a satellite radio, in accordance with the current invention;

FIG. 1A is an illustration of another embodiment of a system for accessing a quiescent mobile vehicle equipped with a telematics unit and a satellite radio, in accordance with the current invention;

FIG. 2 is a flow diagram of one embodiment of a method for accessing a quiescent mobile vehicle equipped with a telematics unit and a satellite radio, in accordance with the current invention;

FIG. 3 is an illustration of one embodiment of a system for initiating a vehicle data upload at a plurality of mobile vehicles, in accordance with the current invention; and

FIG. 4 is a flow diagram of one embodiment of a method for initiating a vehicle data upload function at a plurality of mobile vehicles, in accordance with the current invention.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

FIG. 1 illustrates one embodiment of a system for accessing a quiescent mobile vehicle equipped with a telematics unit and a satellite radio receiver, in accordance with the present invention at **100**. The invention leverages the infrastructure of a satellite radio system to communicate with a telematics unit of a mobile vehicle, requesting the in-vehicle phone to call a telematics service call center or to perform another function. A satellite radio in a quiescent mobile vehicle monitors a broadcast channel and receives a broadcasted message requesting an in-vehicle phone to call a telematics call center. The telematics unit is awakened from a powered-down state so that it call a telematics call center, establish bi-directional communications, and perform a requested telematics service.

Mobile vehicle access system **100** includes a mobile vehicle **110**, a telematics unit **120**, a satellite radio receiver **140**, one or more telematics service call centers **150**, one or more satellite radio service uplink facilities **160**, one or more terrestrial radio transmitters **170**, one or more satellite radio service geostationary satellites **180**, a cellular phone network, and a wireless carrier system **190**.

Mobile vehicle **110** is a vehicle equipped with suitable hardware and software for transmitting and receiving voice and data communications. Mobile vehicle **110** contains telematics unit **120**. Telematics unit **120** includes a digital signal processor (DSP) **122** connected to a wireless analog, digital or dual-mode modem **124**, a global positioning system (GPS) unit **126**, an in-vehicle memory **128**, a microphone **130**, one or more speakers **132**, and a network access device (NAD) or in-vehicle mobile phone **134**. In-vehicle mobile phone **134** is an analog, digital, or dual-mode cellular phone. GPS unit **126** provides, for example, longitude and latitude coordinates of the vehicle.

DSP **122** uses instructions and data from a computer usable medium that contain various computer programs for controlling programming and operational modes within mobile vehicle **110**. Digital signals activate the programming mode and operation modes, as well as provide input and output data.

Satellite radio receiver **140** is any suitable hardware for receiving satellite radio broadcast signals in mobile vehicle **110**. Satellite radio receiver **140** receives digital signals from a terrestrial radio transmitter **170** or a satellite radio service geostationary satellite **180**. Satellite radio receiver **140** includes a radio receiver for receiving broadcast radio information over one or more channels. Satellite radio receiver **140** generates audio output. Satellite radio receiver **140** is embedded within telematics unit **120**. Satellite radio receiver **140** provides channel and signal information to telematics unit **120**. Telematics unit **120** monitors, filters and sends signals that are received from satellite broadcasts, radio broadcasts or other wireless communication systems to output devices such as speaker **132** and visual display devices.

Telematics service call center **150** is a location where many calls are received and serviced at the same time, or where many calls are sent at the same time. The call center prescribes communications to and from mobile vehicle **110**. Telematics service call center **150** is a voice call center, providing verbal communications between an advisor in the call center and a subscriber in a mobile vehicle. Telematics service call center **150** contains one or more switches, one or more data transmission devices, one or more communication services managers, one or more communication services databases, one or more real or virtual advisors, and one or more bus systems.

When telematics service call center **150** receives a request from a telematics subscriber that requires communication with a powered-down or quiescent mobile vehicle, telematics service call center **150** sends command information to satellite radio uplink facility **160** that includes a request for telematics unit **120** to call the telematics service call center **150**.

As part of a satellite broadcast system, a satellite radio uplink facility **160** sends and receives radio signals from a geostationary satellite **180**. Satellite radio uplink facility **160** uplinks command information from telematics service call center **150** to one or more terrestrial radio transmitters **170**. Satellite radio uplink facility **160** also sends the command and other radio signals to geostationary satellite **180**.

Terrestrial radio transmitter **170** and geostationary satellite **180** transmits radio signals to satellite radio receiver **140** in mobile vehicle **110**. Terrestrial radio transmitter **170** and geostationary satellite **180** broadcasts, for example, over a spectrum in the "S" band (2.3 GHz) that has been allocated by the U.S. Federal Communications Commission (FCC) for nationwide broadcasting of satellite-based Digital Audio Radio Service (DARS). The broadcast is, for example, a 120 kilobit-per-second portion of the bandwidth designated for command signals from telematics service call center **150** to mobile vehicle **110**.

Broadcast transmissions provided by a satellite radio broadcast system are sent from geostationary satellite **180** or terrestrial radio transmitter **170** to satellite radio receiver **140**. In addition to music and entertainment, traffic information, road construction information, advertisements, news and information on local events, a command signal is sent to satellite radio receiver **140** to awaken telematics unit **120** with a request for in-vehicle mobile phone **134** to call telematics service call center **150**. Telematics unit **120** monitors satellite radio system broadcast signals received by satellite radio receiver **140** for a command signal, and when a command signal is detected, the command signal and information is extracted from the broadcast channel. Telematics unit **120** retrieves data and information from the audio signals of satellite radio receiver **140**.

The command signal includes a request for telematics unit **120** to call telematics service call center **150**. In response, telematics unit **120** places a call with in-vehicle mobile phone **134** via wireless carrier system **190**.

Wireless carrier system **190** is a wireless communications carrier. Wireless carrier system **190** is, for example, a mobile telephone system. The mobile telephone system is an analog mobile telephone system operating over a prescribed band nominally at 800 MHz. The mobile telephone system is a digital mobile telephone system operating over a prescribed band nominally at 800 MHz, 900 MHz, 1900 MHz, or any suitable band capable of carrying mobile communications. Wireless carrier system **190** transmits to and receive signals from mobile vehicle **110**. Wireless carrier system **190** is connected with other communication and landline networks. Telematics service call center **150** is connected to wireless carrier system **190** with a land-based network, a wireless network, or a combination of landline and wireless networks.

FIG. 1A illustrates one embodiment of system for data transmission over a wireless communication system, in accordance with the present invention at **100**. Mobile vehicle communication system (MVCS) **100** includes a mobile vehicle communication unit (MVCU) **110**, a vehicle communication network **112**, a telematics unit **120**, one or more wireless carrier systems **140**, one or more communication networks **142**, one or more land networks **144**, one or more client, personal or user computers **150**, one or more web-hosting portals **160**, and one or more call centers **170**. In one embodiment, MVCU **110** is implemented as a mobile vehicle equipped with suitable hardware and software for transmitting and receiving voice and data communications. MVCS **100** may include additional components not relevant to the present discussion. Mobile vehicle communication systems and telematics units are known in the art.

MVCU **110** may also be referred to as a mobile vehicle throughout the discussion below. In operation, MVCU **110** may be implemented as a motor vehicle, a marine vehicle, or as an aircraft. MVCU **110** may include additional components not relevant to the present discussion.

MVCU **110**, via a vehicle communication network **112**, sends signals to various units of equipment and systems (detailed below) within MVCU **110** to perform various functions such as unlocking a door, opening the trunk, setting personal comfort settings, and calling from telematics unit **120**. In facilitating interactions among the various communication and electronic modules, vehicle communication network **112** utilizes network interfaces such as controller-area network (CAN), International Organization for Standardization (ISO) Standard 9141, ISO Standard 11898 for high-speed applications, ISO Standard 11519 for lower speed applications, and Society of Automotive Engineers (SAE) Standard J1850 for high-speed and lower speed applications. Vehicle network **112** may also be referred to as a vehicle bus.

MVCU **110**, via telematics unit **120**, sends and receives radio transmissions from wireless carrier system **140**. Wireless carrier system **140** is implemented as any suitable system for transmitting a signal from MVCU **110** to communication network **142**.

Telematics unit **120** includes a digital signal processor (DSP) **122** connected to a wireless modem **124**, a global positioning system (GPS) unit **126**, an in-vehicle memory **128**, a microphone **130**, one or more speakers **132**, and a network access device (NAD) or an embedded or in-vehicle mobile phone **134**. In other embodiments, telematics unit **120** may be implemented without one or more of the above listed components, such as, for example speakers **132**. Telematics unit **120** may include additional components not relevant to the present discussion.

In one embodiment, DSP **122** is implemented as a microcontroller, controller, host processor, or vehicle communications processor. In an example, DSP **122** is implemented as an application specific integrated circuit (ASIC). In another embodiment, DSP **122** is implemented as a processor working in conjunction with a central processing unit (CPU) performing the function of a general purpose processor. GPS unit **126** provides longitude and latitude coordinates of the vehicle responsive to a GPS broadcast signal received from one or more GPS satellite broadcast systems (not shown). In-vehicle mobile phone **134** is a cellular-type phone, such as, for example an analog, digital, dual-mode, dual-band, multi-mode or multi-band cellular phone.

DSP **122** executes various computer programs that affect operational modes of electronic and mechanical systems within MVCU **110**. DSP **122** controls communications (e.g. call signals) between telematics unit **120**, wireless carrier system **140**, and call center **170**. In one embodiment, a voice-recognition application is installed in DSP **122** that can translate human voice input through microphone **130** to digital signals. DSP **122** generates and accepts digital signals transmitted between telematics unit **120** and a vehicle communication

network **112** that is connected to various electronic modules in the vehicle. In one embodiment, these digital signals activate the programming mode and operation modes, as well as provide for data transfers. In this embodiment, signals from DSP **122** are translated into voice messages and sent out through speaker **132**.

Communication network **142** includes services from one or more mobile telephone switching offices and wireless networks. Communication network **142** connects wireless carrier system **140** to land network **144**. Communication network **142** is implemented as any suitable system or collection of systems for connecting wireless carrier system **140** to MVCU **110** and land network **144**.

Land network **144** connects communication network **142** to client computer **150**, web-hosting portal **160**, and call center **170**. In one embodiment, land network **144** is a public-switched telephone network (PSTN). In another embodiment, land network **144** is implemented as an Internet protocol (IP) network. In other embodiments, land network **144** is implemented as a wired network, an optical network, a fiber network, other wireless networks, or any combination thereof. Land network **144** is connected to one or more landline telephones. Communication network **142** and land network **144** connect wireless carrier system **140** to web-hosting portal **160** and call center **170**.

Client, personal or user computer **150** includes a computer usable medium to execute Internet browser and Internet-access computer programs for sending and receiving data over land network **144** and optionally, wired or wireless communication networks **142** to web-hosting portal **160**. Personal or client computer **150** sends user preferences to web-hosting portal through a web-page interface using communication standards such as hypertext transport protocol (HTTP), and transport-control protocol and Internet protocol (TCP/IP). In one embodiment, the data includes directives to change certain programming and operational modes of electronic and mechanical systems within MVCU **110**.

In operation, a client utilizes computer **150** to initiate setting or re-setting of user-preferences for MVCU **110**. In an example, a client utilizes computer **150** to initiate a restricted use mode (e.g. a low-power mode) that telematics unit **120** in MVCU **110** operates within for a user specified period of time. User-preference data from client-side software is transmitted to server-side software of web-hosting portal **160**. User-preference data is stored at web-hosting portal **160**.

Web-hosting portal **160** includes one or more data modems **162**, one or more web servers **164**, one or more databases **166**, and a network system **168**. Web-hosting portal **160** is connected directly by wire to call center **170**, or connected by phone lines to land network **144**, which is connected to call center **170**. In an example, web-hosting portal **160** is connected to call center **170** utilizing an IP network. In this example, both components, web-hosting portal **160** and call center **170**, are connected to land network **144** utilizing the IP network. In another example, web-hosting portal **160** is connected to land network **144** by one or more data modems **162**. Land network **144** sends digital data to and from modem **162**, data that is then transferred to web server **164**. Modem **162** may reside inside web server **164**. Land network **144** transmits data communications between web-hosting portal **160** and call center **170**.

Web server **164** receives user-preference data from user computer **150** via land network **144**. In alternative embodiments, computer **150** includes a wireless modem to send data to web-hosting portal **160** through a wireless communication network **142** and a land network **144**. Data is received by land network **144** and sent to one or more web servers **164**. In one embodiment, web server **164** is implemented as any suitable hardware and software capable of providing web services to help change and transmit personal preference settings from a client at computer **150** to telematics unit **120** in MVCU **110**. Web server **164** sends to or receives from one or more databases **166** data transmissions via network system **168**. Web server **164** includes computer applications and files for managing and storing personalization settings supplied by the client, such as

door lock/unlock behavior, radio station preset selections, climate controls, custom button configurations and theft alarm settings. For each client, the web server potentially stores hundreds of preferences for wireless vehicle communication, networking, maintenance and diagnostic services for a mobile vehicle.

In one embodiment, one or more web servers **164** are networked via network system **168** to distribute user-preference data among its network components such as database **166**. In an example, database **166** is a part of or a separate computer from web server **164**. Web server **164** sends data transmissions with user preferences to call center **170** through land network **144**.

Call center **170** is a location where many calls are received and serviced at the same time, or where many calls are sent at the same time. In one embodiment, the call center is a telematics call center, facilitating communications to and from telematics unit **120** in MVCU **110**. In an example, the call center is a voice call center, providing verbal communications between an advisor in the call center and a subscriber in a mobile vehicle. In another example, the call center contains each of these functions. In other embodiments, call center **170** and web-hosting portal **160** are located in the same or different facilities.

In an example, a client utilizes telematics unit **120** in MVCU **110** to communicate with an advisor in call center **170** to initiate a restricted use mode (e.g. a low-power mode) that telematics unit **120** in MVCU **110** operates within for a user specified period of time. In another example, a client utilizes land network **144** (e.g. a land line) to communicate with an advisor in call center **170** to initiate a restricted use mode (e.g. a low-power mode) that telematics unit **120** in MVCU **110** operates within for a user specified period of time.

Call center **170** contains one or more voice and data switches **172**, one or more communication services managers **174**, one or more communication services databases **176**, one or more communication services advisors **178**, and one or more network systems **180**.

Switch **172** of call center **170** connects to land network **144**. Switch **172** transmits voice or data transmissions from call center **170**, and receives voice or data transmissions from telematics unit **120** in MVCU **110** through wireless carrier system **140**, communication network **142**, and land network **144**. Switch **172** receives data transmissions from and sends data transmissions to one or more web-hosting portals **160**. Switch **172** receives data transmissions from or sends data transmissions to one or more communication services managers **174** via one or more network systems **180**.

Communication services manager **174** is any suitable hardware and software capable of providing requested communication services to telematics unit **120** in MVCU **110**. Communication services manager **174** sends to or receives from one or more communication services databases **176** data transmissions via network system **180**. Communication services manager **174** sends to or receives from one or more communication services advisors **178** data transmissions via network system **180**. Communication services database **176** sends to or receives from communication services advisor **178** data transmissions via network system **180**. Communication services advisor **178** receives from or sends to switch **172** voice or data transmissions.

Communication services manager **174** provides one or more of a variety of services, including enrollment services, navigation assistance, directory assistance, roadside assistance, business or residential assistance, information services assistance, emergency assistance, communications assistance, and managing registration requests. Communication services manager **174** receives service-preference requests for a variety of services from the client via computer **150**, web-hosting portal **160**, and land network **144**. Communication services manager **174** transmits user-preference and other data to telematics unit **120** in MVCU **110** through wireless carrier system **140**, communication network **142**, land network **144**, voice and data switch **172**, and network system **180**.

Communication services manager **174** stores or retrieves data and information from communication services database **176**. Communication services manager **174** may provide requested information to communication services advisor **178**.

In one embodiment, communication services advisor **178** is implemented as a real advisor. In an example, a real advisor is a human being in verbal communication with a user or subscriber (e.g. a client) in MVCU **110** via telematics unit **120**. In another embodiment, communication services advisor **178** is implemented as a virtual advisor. In an example, a virtual advisor is implemented as a synthesized voice interface responding to requests from telematics unit **120** in MVCU **110**.

Communication services advisor **178** provides services to telematics unit **120** in MVCU **110**. Services provided by communication services advisor **178** include enrollment services, navigation assistance, real-time traffic advisories, directory assistance, roadside assistance, business or residential assistance, information services assistance, emergency assistance, communications assistance, and registration request management. Communication services advisor **178** communicate with telematics unit **120** in MVCU **110** through wireless carrier system **140**, communication network **142**, and land network **144** using voice transmissions, or through communication services manager **174** and switch **172** using data transmissions. Switch **172** selects between voice transmissions and data transmissions.

In operation, an incoming call is routed to telematics unit **120** within mobile vehicle **110** from call center **170**. In one embodiment, the call is routed to telematics unit **120** from call center **170** via land network **144**, communication network **142**, and wireless carrier system **140**.

FIG. 2 illustrates one embodiment of a method for establishing communications with a quiescent mobile vehicle equipped with a telematics unit and a satellite radio receiver, in accordance with the present invention at **200**. Quiescent mobile vehicle access method **200** sends a command signal in a satellite radio broadcast, which contains information that requests that a particular in-vehicle mobile phone call a telematics service call center.

A telematics service call center receives a service request from telematics service subscriber, as seen at block **205**. A telematics service subscriber requests, for example, that the door of a vehicle be unlocked or that the vehicle's horn be honked and lights be flashed to help locate the vehicle in a large parking garage.

The telematics service call center sends command information to satellite radio uplink facility in response to the service request, as seen at block **210**. The command information is sent to the satellite radio uplink facility over landline or wireless links. The information includes a request for the telematics unit of the vehicle to call the call center along with a telematics unit identifier associated with the vehicle for which a service has been requested. The telematics unit identifier is a vehicle identification number, a mobile phone identification number, an electronic serial number of the telematics unit, or a satellite radio receiver identification number associated with the satellite radio receiver.

The satellite radio uplink facility uplinks command information from a satellite radio uplink facility to a geostationary satellite, as seen at block **215**. A computer application at a satellite radio uplink facility controls the sending of command signals that are received from telematics service call centers. The satellite radio uplink facility also uplinks command information to a terrestrial radio transmitter for local or metropolitan broadcasts, as seen at block **215**. Satellite radio terrestrial radio transmitters receive radio signals from a geostationary satellite, amplify the signals, and rebroadcast the signals.

The command signal is transmitted in a satellite radio broadcast from one of a geostationary satellite and a terrestrial radio transmitter of a satellite radio service, as seen at block **220**. The command signal is transmitted using a predetermined broadcast channel. The command signal is transmitted, for example, over a spectrum allocated for nationwide broadcasting of satellite-based DARS. The geostationary satellite transmits radio signals with data to a satellite radio receiver in the mobile vehicle.

A satellite radio system broadcast channel is monitored by a computer application in the DSP of the telematics unit for a command signal, as seen at block **225**. The command signal for the designated vehicle includes a telematics unit identifier, identifying the vehicle for which a service has been requested.The command signal is extracted from the broadcast channel, as seen at block **230**. The broadcast channel is monitored for particular command strings or protocol, and the command signal is extracted for further processing when a particular telematics unit identifier is ascertained. The command signal includes a telematics unit identifier, which is a vehicle identification number, a mobile phone identification number, an electronic serial number, or a satellite radio receiver identification number. The command signal includes a directive for the telematics unit to awaken from a sleep mode. The command signal indicates to the telematics unit that the in-vehicle mobile phone should place a call to a predetermined telephone number of the telematics service call center.The in-vehicle or embedded cell phone then is powered-up based on the command signal, as seen at block **235**. The telematics unit initiates a call from the in-vehicle cell phone to a telematics service call center in response to the command signal, as seen at block **240**. The cell phone remains powered up for a predetermined time period before returning to a quiescent state to ensure that the call center service request is completed and that there are no additional service requests pending. The cell phone operates in one of an analog mode or a digital mode.

The telematics service call center receives the call from the mobile phone in the mobile vehicle for which a telematics subscriber has requested service, and then the telematics service center sends back a service request. The telematics unit receives the telematics service request from the telematics service call center, as seen at block **245**, after which the digital signal processor in the telematics unit initiates or controls the response to the telematics service request in the mobile vehicle, as seen at block **250**. The telematics service includes, for example, unlocking doors, honking a horn, reading the GPS location of the vehicle, or flashing the headlights. The service is needed, for example, when an owner needs to locate the vehicle in a large parking garage and the honking of the car and the flashing of the headlights helps identify the location of the car. The telematics service is, for example, to send the current GPS location of a stolen vehicle, which helps law enforcement authorities in retrieving the vehicle.

After the telematics service has been completed, the telematics unit, optionally, sends to the call center an acknowledgement of receiving the request and of completing the service, as seen at block **255**. The cell phone remains powered up for a predetermined time period to insure that the call center has no additional requests for the mobile vehicle before returning to a quiescent state.

FIG. 3 illustrates one embodiment of a system for initiating a vehicle data upload function at a plurality of mobile vehicles, in accordance with the present invention at **300**. The invention leverages the infrastructure of a satellite radio system to communicate with a plurality of mobile vehicles and instruct the telematics units in the vehicles to perform a vehicle data upload function. A call center initiates a vehicle data upload command signal and broadcasts the vehicle data upload command signal over a satellite radio channel. Satellite radios in the mobile vehicles monitor a broadcast channel and receive a broadcasted message requesting performance of the vehicle data upload function.

Vehicle data upload function initiation system **300** includes a plurality of mobile vehicles **310**. Each mobile vehicle comprises a telematics unit **320**, a satellite radio receiver **340**, one or more call centers **350**, one or more satellite radio service uplink facilities **360**, one or more terrestrial radio transmitters **370**, one or more satellite radio service geostationary satellites **380**, a cellular phone network, and a wireless carrier system **390**.

The plurality of mobile vehicles **310** is a group of vehicles equipped with suitable hardware and software for transmitting and receiving voice and data communications. The telematics unit **320** of each vehicle includes a DSP **322** connected to a wireless analog, digital or dual-mode modem **324**, a global positioning system (GPS) unit **326**, an in-vehicle memory **328**, a microphone **330**, one or more speakers **332**, and a network access device (NAD) or in-vehicle mobile phone **334**. In-vehicle mobile phone **334** is an analog, digital, or dual-mode cellular phone. GPS unit **326** provides, for example, longitude and latitude coordinates of the vehicle.

DSP **322** uses instructions and data from a computer usable medium that contain various computer programs for controlling programming and operational modes within each vehicle of the plurality of mobile vehicles **310**. Digital signals activate the programming mode and operation modes, as well as provide input and output data.

Satellite radio receiver **340** is any suitable hardware for receiving satellite radio broadcast signals in each vehicle of the plurality of mobile vehicles **310**. Satellite radio receiver **340** receives digital signals from a terrestrial radio transmitter **370** or a satellite radio service geostationary satellite **380**. Satellite radio receiver **340** includes a radio receiver for receiving broadcast radio information over one or more channels. Satellite radio receiver **340** generates audio output. Satellite radio receiver **340** is embedded within telematics unit **320**. Satellite radio receiver **340** provides channel and signal information to telematics unit **320**. Telematics unit **320** monitors, filters and sends signals that are

received from satellite broadcasts, radio broadcasts or other wireless communication systems to output devices such as speaker **332** and visual display devices.

Call center **350** is a location where many calls are received and serviced at the same time, or where many calls are sent at the same time. The call center prescribes communications to and from the plurality of mobile vehicles **310**. In one embodiment of the invention, the call center is a telematics call center, facilitating communications to and from telematics unit **320** in each vehicle of the plurality of mobile vehicles **310**. In another embodiment of the invention, call center **350** is a voice call center, providing verbal communications between an advisor in the call center and a subscriber in each vehicle of the plurality of mobile vehicles. In another embodiment of the invention, call center **350** contains each of these functions. Call center **350** contains one or more switches, one or more data transmission devices, one or more communication services managers, one or more communication services databases, one or more real or virtual advisors, and one or more bus systems.

When call center **350** initiates a vehicle data upload function in a plurality of mobile vehicles, call center **350** sends command information to satellite radio uplink facility **360**. The command information includes a request for the telematics unit **320** in each vehicle of the plurality of mobile vehicles to perform a vehicle data upload function.

As part of a satellite broadcast system, a satellite radio uplink facility **360** sends and receives radio signals from a geostationary satellite **380**. Satellite radio uplink facility **360** transmits command information from call center **350** to one or more terrestrial radio transmitters **370**. Satellite radio uplink facility **360** also sends the command information and other radio signals to geostationary satellite **380**.

Terrestrial radio transmitter **370** and geostationary satellite **380** transmits radio signals to satellite radio receiver **340** in each vehicle of the plurality of mobile vehicles **310**. Terrestrial radio transmitter **370** and geostationary satellite **380** broadcasts, for example, over a spectrum in the "S" band (2.3 GHz) that has been allocated by the U.S. Federal Communications Commission (FCC) for nationwide broadcasting of satellite-based DARS. The broadcast is, for example, a 120 kilobyte-per-second portion of the bandwidth designated for command signals from call center **350** to the plurality of mobile vehicles **310**.

Broadcast transmissions provided by a satellite radio broadcast system is sent from geostationary satellite **380** or terrestrial radio transmitter **370** to satellite radio receiver **340** in each vehicle. In addition to music and entertainment, traffic information, road construction information, advertisements, news and information on local events, a vehicle data upload command signal is sent to satellite radio receiver **340** in each vehicle to instruct telematics unit **320** of each vehicle of the plurality of mobile vehicles to perform a vehicle data upload function. The vehicle data upload command signal comprises a plurality of telematics unit identifiers that identifies the mobile vehicles belonging to the plurality of mobile vehicles **310**. Each telematics unit **320** monitors satellite radio system broadcast signals received by satellite radio receiver **340** for the vehicle data upload command signal and a telematics unit identifier that corresponds to the vehicle. When a corresponding telematics unit identifier and the vehicle data upload command signal are detected, the vehicle data upload command signal and information is extracted from the broadcast channel.

In one embodiment of the invention, the vehicle data upload command signal includes a request for the telematics unit **320** in each vehicle of the plurality of mobile vehicles to initiate a vehicle data upload call to call center **350** thereby allowing the call center to pull stored vehicle data. In response, telematics unit **320** places a vehicle data upload call with in-vehicle mobile phone **334** via wireless carrier system **390**. In another embodiment of the invention,

vehicle data upload command signal includes a request for the telematics unit **320** in each vehicle of the plurality of mobile vehicles to initiate a vehicle data storage, for future upload of the vehicle data type to call center **350**.

Wireless carrier system **390** is a wireless communications carrier. Wireless carrier system **390** is, for example, a mobile telephone system. The mobile telephone system is an analog mobile telephone system operating over a prescribed band nominally at 800 MHz. The mobile telephone system is a digital mobile telephone system operating over a prescribed band nominally at 800 MHz, 900 MHz, 1900 MHz, or any suitable band capable of carrying mobile communications. Wireless carrier system **390** transmits signals to and receives signals from the plurality of mobile vehicles **310**. Wireless carrier system **390** is connected with other communication and landline networks. Call center **350** is connected to wireless carrier system **390** with a land-based network, a wireless network, or a combination of landline and wireless networks.

FIG. 4 shows one embodiment of a method for processing vehicle data at a plurality of mobile vehicles, in accordance with the present invention at **400**. Processing vehicle data at a plurality of mobile vehicles method **400** comprises steps to send a vehicle data upload command signal in a satellite radio broadcast, which contains information that requests a plurality of mobile vehicles perform a vehicle data upload function.

Each vehicle is equipped with a telematics unit and a satellite radio receiver. Vehicle related information is automatically stored and uploaded to a call center upon the occurrence of specified events in a vehicle. Internal triggers such as miles traveled, engine running time, or number of ignition events are used to initiate the upload of any of a number of vehicle parameters. An external trigger is useful in balancing peak call times so that the number of vehicles placing calls to a call center is more uniformly dispersed over time. The external trigger is also useful in allowing a group of vehicles to capture data simultaneously, such as, at a specific time or at the occurrence of a geographic based diagnostic event.

The call center determines the plurality of mobile vehicles based on service criteria (block **405**). Examples of service criteria used by the call center comprise a vehicle performance issue associated with a group of mobile vehicles, a particular mobile vehicle model, an environmental condition in a geographic area, or a maintenance bulletin issued for a group of mobile vehicles. The call center generates vehicle data upload command signals for a plurality of mobile vehicles in response to various events. An example of an event that prompts the call center to initiate a vehicle data upload command signal is a geographic based diagnostic event. A geographic based diagnostic event is the occurrence of various factors in a particular geographic area that affect the performance, reliability, or operability of a group of mobile vehicles. Those factors include, for example, extreme temperatures, high humidity, or dusty conditions. The call center also generates vehicle data upload command signals for a plurality of mobile vehicles to for use in providing maintenance or warranty related services. The vehicle data upload command signal comprises a vehicle data type, such as an air mixture ratio, or oxygen sensor reading, of interest to the call center.

The call center initiates the vehicle data upload command signal by generating the vehicle data upload command signal (block **410**) and sending the vehicle data upload command signal to the satellite radio uplink facility (block **415**). The vehicle data upload command signal is sent to the satellite radio uplink facility over landline or wireless links. The command includes a request for the telematics unit of each mobile vehicle in the plurality of mobile vehicles to perform a vehicle data upload function along with a telematics unit identifier associated with each mobile vehicle in the plurality of mobile vehicles. The call center includes the telematics unit identifiers of the vehicles from which data is required. Examples of telematics unit identifiers are: a vehicle identification number, a mobile phone identification number, an electronic serial number of the telematics unit, or a satellite radio receiver identification number associated with the satellite radio receiver.

The vehicle data upload command is associated with a vehicle type, for example vehicle model or engine manufacture. Other factors such as geographic location are also used in generating the vehicle data upload command.

The satellite radio uplink facility transmits vehicle data upload commands from a satellite radio uplink facility to a geostationary satellite (block **420**). A computer application at a satellite radio uplink facility controls the sending of vehicle data upload command signals received from the call center. The satellite radio uplink facility also transmits vehicle data upload commands to a terrestrial radio transmitter for local or metropolitan broadcasts. Satellite radio terrestrial radio transmitters receive radio signals from a geostationary satellite, amplify the signals, and rebroadcast the signals.

The vehicle data upload command signal is transmitted in a satellite radio broadcast from one of a geostationary satellite and/or a terrestrial radio transmitter of a satellite radio service (block **425**). The vehicle data upload command signal is transmitted using a predetermined broadcast channel. The vehicle data upload command signal is transmitted, for example, over a spectrum allocated for nationwide broadcasting of satellite-based DARS. Geostationary satellite transmits radio signals with data to a satellite radio receiver in the mobile vehicle.

A satellite radio system broadcast channel is monitored by a computer application in the DSP of the telematics unit for a vehicle data upload command signal (block **430**). The vehicle data upload command signal for the designated vehicles include a plurality of telematics unit identifiers, identifying the mobile vehicles that are to perform the vehicle data upload function. The mobile vehicles determine whether the vehicle data upload command signal corresponds to the mobile vehicle (block **435**). The determination is made by comparing the plurality of telematics unit identifiers of the vehicle data upload command signal to the telematics unit identifier of the mobile vehicle (block **440**)

and detecting if one of the plurality of telematics unit identifiers of the vehicle data upload command signal matches the telematics unit identifier of the mobile vehicle (block **445**).The vehicle data upload command signal is extracted from the broadcast channel (block **450**). The broadcast channel is monitored for particular command strings or protocol, and the vehicle data upload command signal is extracted for further processing when a particular telematics unit identifier is detected. The vehicle data upload command signal includes a telematics unit identifier, which is a vehicle identification number, a mobile phone identification number, an electronic serial number, or a satellite radio receiver identification number. The vehicle data upload command signal comprises instructions for the telematics unit to perform a vehicle data upload function (block **455**).

The vehicle data upload function comprises initiating a vehicle data upload call (block **460**) or initiating a vehicle data storage (block **465**). The vehicle data upload call occurs when the vehicle data upload command signal directs the telematics unit to place a cell phone call to the call center so that the call center can pull a stored vehicle data. The stored vehicle data is a vehicle data type, such as, vehicle performance data, vehicle diagnostic data, vehicle status data, or vehicle operational data. The vehicle data storage occurs when the vehicle data upload command signal directs the telematics unit to store vehicle data, of a particular vehicle data type, for upload to the call center at a future time.

While the embodiments of the invention disclosed herein are presently considered to be preferred, various changes and modifications can be made without departing from the spirit and scope of the invention. The scope of the invention is indicated in the appended claims, and all changes that come within the meaning and range of equivalents are intended to be embraced therein.